



## **NASA STTR 2010 Phase I Solicitation**

### **T10 Stennis Space Center**

NASA's Stennis Space Center (SSC) seeks advanced technologies to support its testing rocket engines including innovative approaches for measurement of propellant tank volume, new tools for prediction operational life of critical components, and health monitoring and management of test facilities infrastructure. Technologies are also sought to improve the Center's energy conservation and Sustainability

## **Subtopics**

### **T10.01 Test Area Technologies**

**Lead Center: SSC**

#### **Innovative Approaches to Tank Volume Measurement**

Develop new innovative non-contact methods to measure liquid propellant tank volume and tank fluid level with improved accuracy, repeatability and minimal tank entries for maintenance and calibration. Currently, differential pressure measurements or multiple float switched are typically used. Differential pressure measurements do not provide sufficient accuracy for low density fluids such as liquid hydrogen, and multiple float switch gages only offer readings at discrete tank liquid levels, and are subject to mechanical failure and expensive maintenance. Accuracies of 0.5% or better are desired. Need for improved technology is mid-term, and highly desirable. Expected TRL at end of Phase I is 2, and at the end of Phase II is 6.

#### **Robust Components Technologies**

Develop new innovative tools to predict operational capability and life for key facility components (e.g., valves, valve seals and seats, actuators, flowmeters, tanks, etc.) for ultra high (>8000 psi) pressure, high flow rates, and cryogenic environments. Tools would be used for the design, procurement, and modification of facility components and ideally also incorporated in system models for simulation of test stand operation. Current TRL is 3 for modeling valves and flowmeters. Need for improved technologies are mid-term, and are highly desirable. Expected TRL at end of Phase I is 2, and at the end of Phase II is 5.

#### **Infrastructure Health Monitoring**

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Infrastructure health monitoring and management for test facilities and for widely distributed support systems (WDSS) such as gas distribution and cooling water. Capabilities being sought for WDSS include remote monitoring of vacuum lines, gas leaks, and fire; using wireless technologies in order to eliminate running miles of power and data wires. Proposed innovative systems must lead to improved safety and reduced test costs by use of technologies for automated anomaly detection; diagnosis; determination of faults and their effects; prediction of future anomalies; capture and analysis of usage information; tools for rapid and effective analysis of data, information, and knowledge; and efficient user interfaces to enable integrated awareness of the system condition by users. Effectiveness of technologies in addressing the stated needed capabilities: robustness of wireless monitoring systems, effectiveness of anomaly detection (percent of anomalies captured, percent of false alarms), improvements in safety, and reduction in costs. Need for improved technologies is mid-term, and highly desirable. Expected TRL at end of Phase I is 3, and at the end of Phase II is 6.

### **Cost-Saving Vacuum System Technologies**

The objective here is to prototype and field test vacuum monitoring devices that minimize "touch maintenance" thereby reducing costs and preclude cabling by working wireless. Current state of the art for vacuum jacketed liquid hydrogen (LH) lines is walking the lines and manually performing the required periodic checks and sensor maintenance. The new altitude test stand will produce high vacuum inside a large rocket engine test chamber with ambient pressure outside. Some locations will be difficult or impossible to reach. Due to the unique and harsh environmental nature of this test facility, new technologies and vacuum measurement techniques are needed to monitor this environment. Performance metrics include high accuracy and sensitivity in the 0.1 to 1 psia, insensitivity to high levels of noise and vibration, and ruggedness. Need for improved technologies is short term, and highly desirable. Expected TRL at end of Phase I is 2, and at the end of Phase II is 6.

## **T10.02 Energy Conservation and Sustainability**

### **Lead Center: SSC**

John C Stennis Space Center (SSC) is a large rocket propulsion test facility located in southern Mississippi close to the Louisiana state line. Due to the size of the test facilities, energy consumption is very large. In an effort to conserve on energy, there is an interest in pursuing innovation in the following areas:

### **Innovative Geothermal Technology**

SSC is interested in innovative geothermal technology in an effort to reduce energy consumption, reducing the Center's carbon footprint. The feasibility and application of geothermal technology has not been investigated for use at SSC. SSC is looking for geothermal technology that is cost effective to implement and maintain. There are potential commercial and residential applications. The feasibility of geothermal technology will require an assessment of the local topography, underground soil composition, location of water "sinks", and determination of the area's ground "constant" temperature. Concepts will be evaluated based on their potential efficiency, ease of implementation and maintenance, and flexibility of applications (including, but not limited to, HVAC, preheating hot water heaters, and other means of extracting energy), as well as, applicability to the Center's mission. Proposals will also be evaluated based on the maturity level to which the technology will be developed and innovative techniques.

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### **Innovative Lighting Technology**

Stennis Space Center is interested in developing innovative technologies, systems, or methodologies that will reduce the energy consumption and heat generation from facility lighting while maintaining the desired level of illumination for safety and effective work environments. SSC is interested in innovative lighting technologies for the test area and parking lots. These lighting technologies will need to reduce energy consumption while maintaining a comfortable and safe working environment. SSC is particularly interested in replacing costly lighting in the test area (test stands, hydrogen/oxygen environments, hazardous and potentially corrosive environments). The lighting should be in compliance with IESNA RP 7-01, Practice for Industrial Lighting. Proposals will be evaluated based on the maturity level to which the technology will be developed and innovative techniques that will provide a reasonable life expectancy. Proposals will also be evaluated on implementation strategy and ease of maintenance.

### **Innovative Solar Technology**

Reduction in energy consumption and subsequent energy cost is a high priority at SSC. SSC is interested in developing new technologies for the efficient and effective use of photovoltaic/solar cell to reduce energy costs. Major issues in the development and use of solar panel include efficient system design and installation as well as effective maintenance. Innovative approaches and tools to facilitate the design of efficient solar cell systems, effective application of solar cells systems for building rooftops or a separate field area of solar cells are desired as well as innovative approaches to monitor the health of the system and maintenance methods to insure the most effective and efficient operations of the system in an environment with high humidity, extensive rain showers, high pollen counts, rapid mold and fungal growth, etc.

### **Technologies for Propellant Conservation**

Objective is to minimize usage of costly gases (helium and hydrogen) through devices that can recover/recycle efflux from cryogenic test facilities (currently no recovery is done). This could include technologies such as real time gas sampling/contamination monitoring system for propellant and purge systems that could also help minimize use of non renewable resources such as Helium, or Helium reclamation carts for recapture of inert/purges.